Environmental Toolbox

Technical Module

Introduction

Laws and Regulations

- Contact the legal office to determine the applicability of international treaties and agreements, national laws, host nation laws, mission regulations (United Nations (UN), North Atlantic Treaty Organization (NATO), European Union (EU), Theater command, etc.)

Be prepared to implement the highest applicable environmental standard

Siting Considerations (1 of 2)

Early involvement in the base camp planning process is the best way to positively influence a mission's environmental considerations

- Site operations to
  - Maximize mission effectiveness
  - Maintain accessibility
    - If possible, ensure that proposed operations are accessible by an existing road network
  - Maintain required standoff distances
    - Standoff distances are especially important for force health protection reasons for areas such as: airfield operations, living quarters, base perimeter, wells, surface water sources, potential causes of contamination and sources of noise
    - Cultural and archaeological properties and natural resources
  - Minimize potential health impacts to base personnel and local population

Siting Considerations (2 of 2)

- Minimize impact on the local environment
  - Limit environmental degradation
  - Properly manage and protect natural resources
  - Protect cultural property
- Use existing roads and buildings, if possible
- Properly plan to allow for changes in mission and base population without having to construct additional solid waste and wastewater treatment sites, if at all possible

Climate Data

- Temperature
  - Temperature range and variability can affect equipment performance
- Precipitation
  - Precipitation will affect many aspects of operations including: surface water availability, groundwater recharge rates, effectiveness of evaporation beds and lagoons, potential to conduct burning operations and potential to generate contaminated leachate from solid waste
  - Precipitation data, combined with topographic data, will also help determine siting requirements
- Prevailing wind direction and data
  - Consideration of wind data helps to avoid blowing smoke and other air contamination toward inhabited areas
- Net evaporation rates
  - Use net evaporation rates to determine total size requirements for evaporation beds and lagoons

Topography

- Natural drainage
  - Consider natural drainage and how this will impact the conveyance of storm water through and around the camp
- Slope or elevation
  - Ensure proper slope of sewer lines in order to optimize operation of the wastewater system
- Geological hazards:
  - **Seismic zones** – Avoid placing piping or anything that requires an impermeable liner (e.g., engineered landfill) in a seismic zone due to potential damage in the event of an earthquake
  - **Floodplains, mudslide-prone areas, and other local natural hazards** – Avoid siting operations in areas susceptible to flooding and other natural hazards because they can cause significant disruptions and lead to environmental contamination

Hydrology

- Water quality and quantity
  - The *quality* of water will determine treatment requirements
  - If sufficiently available, groundwater is often a preferred drinking water source
  - The available *quantity* of water will determine the need for delivering potable water and/or reducing use of available resources
- Groundwater resources, depth and availability
  - Engineered landfills or lagoons should not be constructed in areas with high water tables due to the high likelihood of groundwater contamination
- Surface water
  - Surface water is the most accessible water source, but is often the poorest quality
- Protected watersheds or aquifer recharge zones, wetlands
  - Engineered landfills or lagoons should not be constructed near these sites
  - It is best to conduct solid waste and wastewater operations downstream and as far as possible from water sources

Soil Characteristics

- Permeability
  - Highly permeable or porous soil will allow for contaminants to travel more quickly through the soil, which can lead to groundwater contamination or a greater volume of contaminated soil when performing clean up actions
- Bearing capacity (the capacity of soil to support the loads applied to the ground)
  - Loads surpassing the soil's bearing capacity can cause severe settling and failure of the soil

Soil Percolation Rates

Time required for water level to drop 2.5cm in a test hole	Relative absorption rate	Type of soil
0-3 minutes	Rapid	Coarse sand and gravel
3-5 minutes	Medium	Fine sand or sandy loam
5-30 minutes	Slow	Clay, loam, or clay with sands
30-60 minutes	Semi-impervious	Dense clay
> 60 minutes	Impervious	Hardpan or rock
Note: the first two types of soil are suitable for subsurface disposal. They are not suitable for lagoons unless water retention is assisted by the installation of an impermeable liner at the lagoon bottom.		

Cost-Benefit Analysis

- When determining appropriate technologies or procedures it is important to take a holistic approach considering all aspects, such as:
  - Mission requirements
  - Resources (availability of time, manpower, space, equipment, materials and transportation)
  - Lifecycle costs (purchase, maintenance, disposition)
  - Sustainability (energy and water requirements, waste generation)
  - Cultural acceptance
    - Base populace
    - Host nation

Example of a Cost-Benefit Analysis